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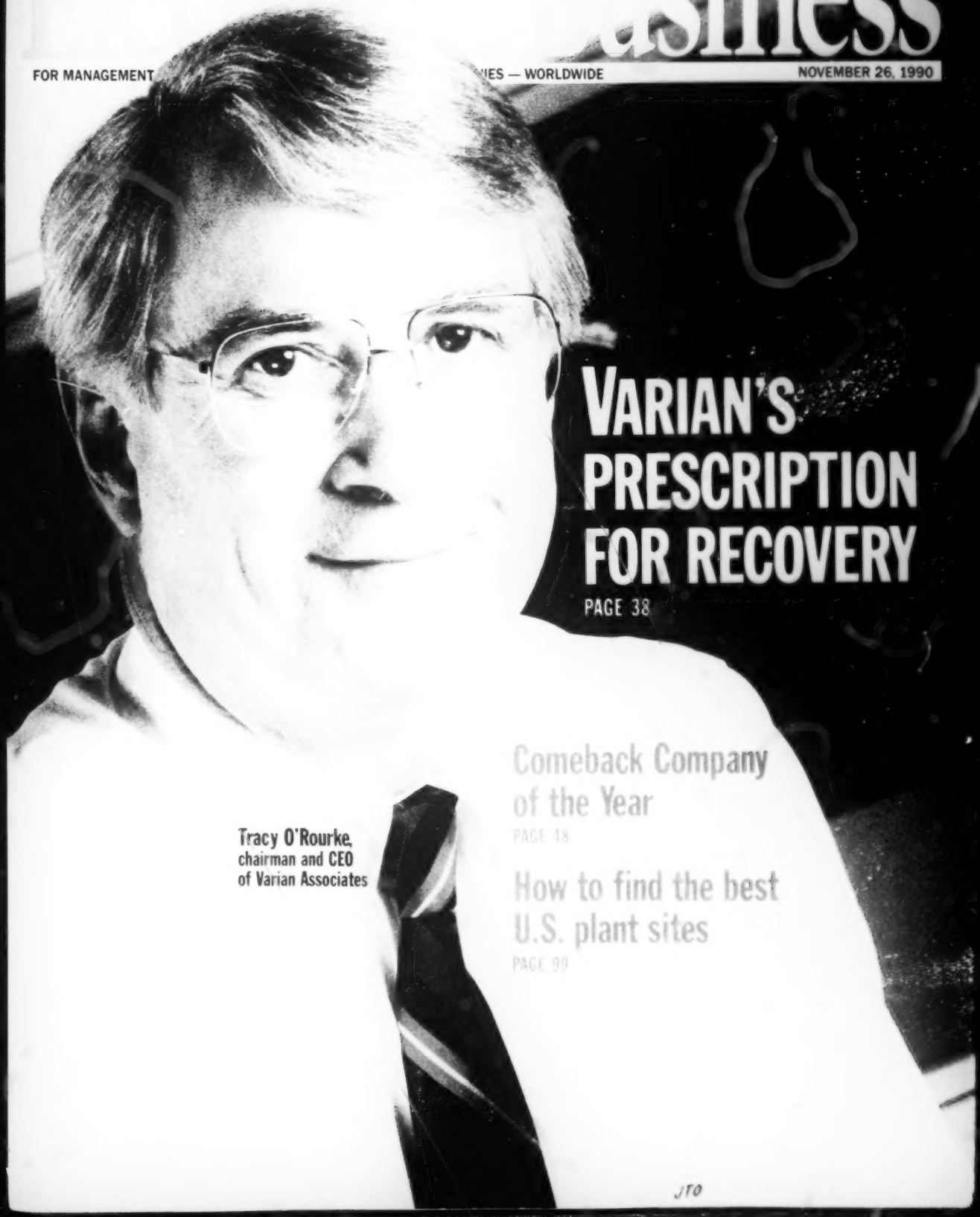

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Tracy O'Rourke, chairman and CEO of Varian Associates

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Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER, AND SYSTEMS COMPANIES — WORLDWIDE

VOL. 16, NO. 22 NOVEMBER 26, 1990

PAGE 38 Executive VP Allen Lauer: "The problem that Varian got into in the 1980s was that it had no strategic focus"

Cover photograph: Christopher Springmann

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38 Varian's O'Rourke writes his prescription for recovery

How do you cure a company that has lost its competitive edge? That was the problem confronting Tracy O'Rourke last winter when he took the job of chairman and CEO at Varian Associates Inc., the well-known manufacturer of semiconductor equipment and medical instruments. O'Rourke decided on an aggressive course of long-term treatment, and the patient is responding

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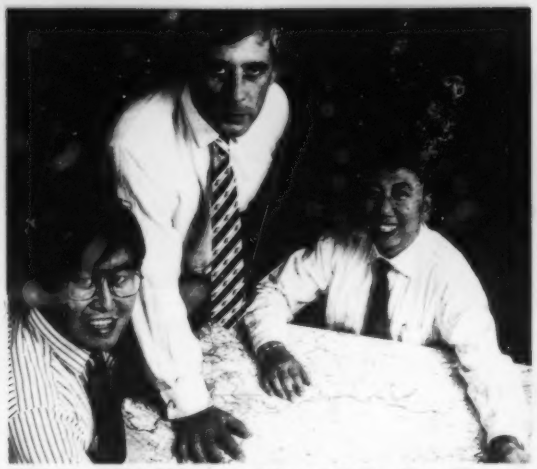
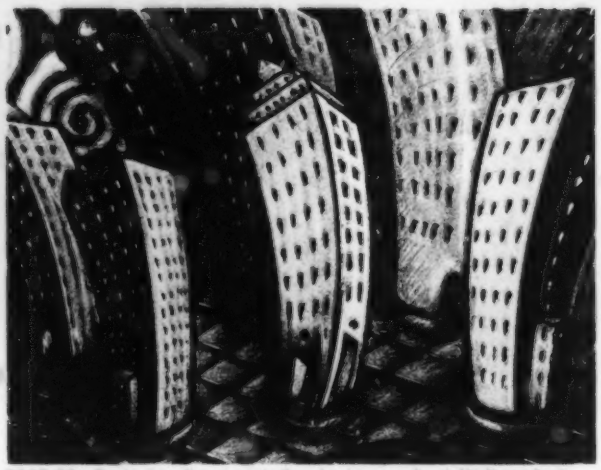
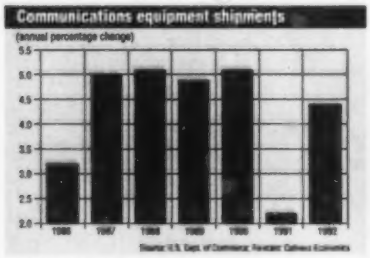


PAGE 71 AMD's PLD team of (from left) Ken Chan, Michael Ballard, Soon Loch is counting on a fast-growth Asian market



PAGE 99 Exclusive directory tells who to see about finding plant sites in U.S.



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Coming back means getting tough

Upturn, recovery, comeback. These are odd, encouraging words in a recessionary business climate where the talk is mostly of sluggish sales growth, eroding profits, and slumping capital spending.

To hear of comeback companies these days is to check their balance sheets with a wary eye and then to ask "How did they do it?" In this issue of ELECTRONIC BUSINESS we look at how two companies—Varian Associates, the subject of our cover story, and IRT Corp., ELECTRONIC BUSINESS's choice for Comeback Company of the Year—managed to buck the cyclical trend and indeed "come back."

On the surface, Varian didn't look like a company in need of dramatic change. But beneath the company's technological prestige and consistent sales growth, explains senior editor Rick Whiting, was an operation out of touch with its customers, slow to roll out new products, and mired in a diversification strategy that was pulling the company apart. Inevitably, profit margins—already narrow for a technological company,—were becoming dangerously thin.

Twenty-million-dollar IRT, meanwhile, was dancing closer and closer to the edge of the abyss, writes associate editor Peter Burrows. Its technology was unique, its headquarters plush, and its prospectus dazzling; but with multimillion-dollar losses becoming chronic, debt soaring, and banks threatening foreclosure, it was time for radical surgery.

Enter the corporate physicians: in Varian's case, recently hired CEO Tracy O'Rourke; at IRT, an unusual team of self-styled managerial "trench rat" John Battin and Wall Street deal maker Clifford Brokaw.

Senior editor Rick Whiting (bottom) and associate editor Peter Burrows: tracking comeback companies

Along with the conventional slashing and cutting, O'Rourke's treatment calls for refocusing on core businesses, streamlining operations, and emphasizing profitability over growth. CEO Battin reined in IRT's freewheeling marketing divisions, sped up the company's transition to volume manufacturing, and put R&D dollars where they would do the most good. Brokaw slashed spending and brokered new deals with IRT's jittery bankers. So far so good.

Two fascinating stories; two companies on the mend; more evidence that positive change can happen if one dares to use tough remedies.

JOHN PARKER, section editor

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BPA ABP

hoping that Seeq's flash—which allows organization of memory into sectors which can be erased and reprogrammed independent of other sectors—will emerge as a standard. Production is planned by the first quarter of next year.

The other main flash competitor is Intel Corp., whose flash chips must be entirely erased and reprogrammed. Philips-Signetics plans to use Seeq's flash in consumer and industrial areas, microcontrollers, and telecom chips.

BARBARA JORGENSEN

HDTV

Taiwan tunes in to HDTV research

IN A BID TO increase the competitiveness of its consumer electronics industry and telecommunications technology, Taiwan's government will spend $190 million in the next five years to develop a high-definition television (HDTV) system in cooperation with the U.S. electronics industry.

Taiwan's Ministry of Economic Affairs recently approved the appropriation to fund the development project of HDTV technology, according to the economic news weekly, *Business Taiwan*. Computer and Communication Research Laboratories and Electronics Research and Service Organization, two technology research institutions, have been appointed to lead the project.

Cheng Ray-yu, general director of CCL, says in a preliminary plan, CCL has proposed to set up an advanced TV (ATV) laboratory in the United States, in addition to the development of such key HDTV technologies as liquid crystal display (LCD), charge-coupled device (CCD), high-speed digital signal processing, high-resolution image processing, and bandwidth compression.

According to Cheng, Taiwan has chosen U.S. companies as potential partners rather than Japanese companies, the world's leader of HDTV technology, for a simple reason. "All the leaders of our program have worked with U.S. companies for years, which makes it easier for us to acquire American technological assistance," says Cheng.

The Japanese HDTV manufacturers, however, have kept their technology top secret. It is reported that if a Japanese-made HDTV breaks down because of a malfunction in a specific part, the Japanese vendor will ask the user to mail in the broken part before sending back a new one. By doing so, it discourages competitors from using extra parts solely for technological experimenting.

Taiwan is the third Asian country, after Japan and South Korea, to announce its government-sponsored HDTV development program. The developer of Japan's Hi-Vision HDTV system, the Japan Broadcasting Corp. (known as NHK), has spent more than 20 years and over $200 million developing Hi-Vision, which became the world's first fully operational HDTV system in June last year. Last June, the Electronic Industries Association of Korea announced its public/private consortium for HDTV development with a five-year budget of $200 million.

Japan keeps its lead in the field through heavy investment. Some industrial analysts estimate that so far, the country has spent between $700 million to $1.4 billion on HDTV development and implementation. In January 1989, Japan's Ministry of International Trade and Industry (MITI) decided to spend $500 million on a 3-year HDTV promotion program. In contrast, the United States and Europe are expected to spend roughly $500 million and $720 million respectively on HDTV development over the next five years.

XIONG XIAOGE

Estimated spending on HDTV for next five years

(From 1991 to 1995, $ millions)

Source: ELECTRONIC BUSINESS

SEMICONDUCTORS

Taiwan, Korea team up as chip partners

U.S. SEMICONDUCTOR companies shopping for Asian partners have a growing number of options from which to choose. Japan's technological expertise remains unrivaled, but both Taiwan and South Korea are coming on strong, according to speakers at The Semiconductor Outlook, an industry forum sponsored by Technologic Partners and Merrill Lynch Capital Markets.

All three countries are good sources of investment capital, says Morris Chang, chairman of the Taiwan Semiconductor Manufacturing Co., "but for cultural affinity, Taiwan is probably the closest to the United States." As for marketing prowess, "Japan is the best [partner] in Japan, but Taiwan is the strongest [partner]in the rest of Asia," he says.

Although Taiwan's fabrication capabilities are on the rise, the country's semiconductor companies lag in applications expertise, says William H. Davidow, general partner at Mohr Davidow Ventures. "They don't know what products to design with their process technology, which makes them ideal partners for fabless semiconductor companies in the United States," he says.

Korea is also eager to establish access to U.S. companies for their design expertise, according to Roger S. Borovoy, a lawyer at Brown & Bain. Borovoy downplayed the potential of Asian companies to appropriate their U.S. partners' intellectual property, noting recent changes that have strengthened patent law.

Given the trend toward fabless operations in the United States and the availability of Asian capital and talent, it is becoming common for start-up companies as well as larger U.S. semiconductor companies to establish Asian ties. That's fine as far as

PCs fuel the hot Asian PLD market

The programmable logic market is one of the chip industry's fastest-growing sectors, and its greatest potential growth is in the Far East

BY ROSS ARENSMAN

By the end of the decade engineers may be able to design PCs on a single densely packed chip, speculates James Huang, director of semiconductor sourcing for Taiwan PC maker Acer Inc. But for the foreseeable future, Acer engineers will have to keep stringing together their most advanced PC designs with the help of programmable logic devices (PLDs)—standard logic chips that can be quickly programmed to handle a variety of tasks.

PLDs provide the "glue" that connects microprocessors, peripherals, and other circuitry in today's PCs. And because customized PLD designs can be created and programmed onto a chip in just a few hours, PLDs have become indispensable tools for PC makers struggling to rush new, more powerful products to market. Huang contends that almost every PC made by Acer today contains 6 to 10 PLDs, usually of the common programmable-array logic (PAL) variety. "Right now it's impossible to do without them," he says.

Demand for PALs and other more sophisticated PLDs has soared in recent years, fueled by widespread use in PCs, enhanced graphics displays, and computer peripherals such as disk drives, modems, and printers. Besides computer products, they are finding their way increasingly into telecommunications equipment like digital switches and PBX systems, as well as industrial controls, test and medical equipment, and even fax machines and consumer electronics.

The industry was reminded of the importance of PLDs earlier this year when demand outstripped worldwide production capacity and created a severe shortage. Spot market prices climbed 20% to 60%, while lead times for purchasing some parts stretched to six months. Several PLD makers increased production in response, however, which appeared to ease the shortage by late summer.

Worldwide PLD sales have grown almost 50%, from $475 million in 1987 to $710 million in 1989, according to the research firm Integrated Circuit Engineering Corp. ICE estimates PLD sales will more than double to $1.7 billion by 1994.

Although the market is still small compared with the memory chips and microprocessors markets, PLDs clearly have turned into one of the industry's hottest growth sectors. Interest in PLDs is particularly strong in Asia, which appears likely to be the world's fastest-growing area for PLD consumption during the next decade.

About $100 million worth of PLDs were sold in Japan last year, according to ICE, while sales in the rest of Asia were over $50 million. The entire region accounted for between 20% and 25% of worldwide PLD sales in 1989, and by 1994 it is expected to generate nearly 35% of the total sales.

"I think Asia will continue to be the fastest-growing market for semiconductors, probably for the rest of the decade—and PLDs will grow as fast as the market, or faster," predicts Michael Ballard, director of Asian sales for U.S.-based Advanced Micro Devices Inc. (AMD), the world's leading PLD manufacturer. He says PLD sales in Asia have doubled during the past three years for the Sunnyvale, Calif.-based company, as has the size of its Hong Kong marketing and support staff, now at 55.

Strong PLD sales are

AMD's PLD team (from left) Ken Chan, Michael Ballard, Soon Loh: counting on Asia being a fast-growth market for PLDs

Hyundai sets sights on PLD market

South Korea's PLD market is still so small that no major market research firms try to measure it. Local industry sources estimate that only about $20 million worth of PLDs are sold annually, with most sales coming from foreign suppliers. But as domestic and international demand for PLDs continues to grow rapidly, at least one of Korea's major chip makers has started to eye the market hungrily.

Hyundai Electronic Industries Co. is the only Korean company currently making PLDs. Hyundai—Korea's number two chip maker—sees PLDs as an opportunity to reduce its heavy reliance on dynamic RAMs.

Han Chang-Seok, senior manager for product planning in the company's semiconductor marketing and sales division, says Hyundai has been looking for ways to expand its non-memory business. Hyundai also wants to meet its own in-house needs for PLDs, he says, and it views PLD manufacturing as a way to use older chip plants after they become unsuitable for memory production.

Hyundai's first PLD chip, the HY18CV8S, is a CMOS-based electrically erasable programmable logic device (EEPLD) developed by International CMOS Technology Inc., a San Jose, Calif., chip design company. Hyundai was an original investor and owns a 30% share in the U.S. company. Hyundai began manufacturing the 300-gate 18CV8 in 1989 and now makes about 200,000 of the chips monthly. At about $1 per chip, that translates into just $2.4 million in annual sales, less than 1% of Hyundai's total chip revenue.

Hyundai is taking a long-term approach to the market and is now developing two higher-end versions of the EEPLD: the 22CV10 and the 22CP210. Like the 18CV8, the new chips will use industry standard architectures and operate at a speed of 25 nanoseconds. But with the equivalent of 600 gates per device, they will offer twice the density of the first generation.

Hyundai's Han Chang-Seok: making the move into the PLD market

Han says Hyundai may also develop a field-programmable gate array, but not soon, because "neither the technology nor the market is mature enough yet."

Han says Hyundai will consume about half of its PLD production internally and sell the rest outside—mostly to Korean systems makers.

Unlike the U.S. and European markets, where demand for PLDs is split fairly evenly among data processing, telecom, and industrial applications, Korea's PLD market is dominated by PC makers. Han estimates that low-density PLDs (under 600 gates) account for about 85% of sales to Korean PC makers.

Ju Jay-Lyang, country manager for Advanced Micro Devices Far East Ltd., agrees there is little current demand for high-speed, high-density chips in Korea. He adds, however, that "as faster PCs are introduced, high-speed devices with lower power consumption will start to look good."

BY GEOFF CRANE in South Korea

also bringing expansion to the Asian operations of National Semiconductor Co. as well. John Phelps, volume product marketing director at the company's Hong Kong office, says National has more than tripled Asian marketing and support staff outside of Japan in recent years to about 200 people, despite financial problems that forced it to close two U.S. plants and lay off 2,000 workers in late August. Much of the rising demand for PLDs in Asia is tied to the region's booming PC industry, he says.

As PC makers turn to 80386 and 80486 microprocessors to design faster systems, PLD suppliers are rushing to bring out new generations of higher-speed PLDs that can keep up the pace. Until this year the fastest any PLD could process a set of instructions using the most prevalent transistor-transistor logic (TTL) technology was 7.5 nanoseconds. But both AMD and Texas Instruments Inc. recently introduced new TTL PLDs rated at 5 nanoseconds.

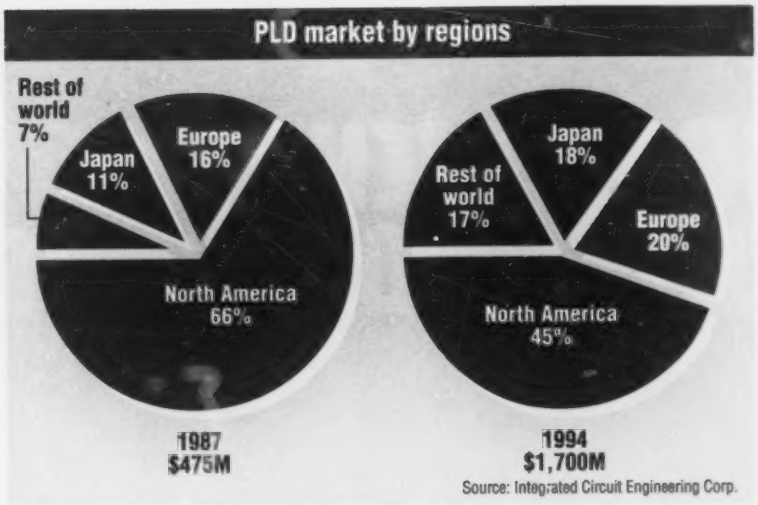
"We see a lot of action in these very high speed devices in the next few years—it will be a very important market for any supplier trying to be a major player," says Gilbert Wai, manager of semiconductors for Texas Instrument's Hong Kong subsidiary.

"The market didn't exist two years ago," he says. "Now people are beating down the doors trying to get their hands on these parts."

Without a doubt, the hottest segment of the PLD market in the 1990s will be CMOS (complementary metal-oxide semiconductor) technology. Bipolar PLD growth peaked in 1988 and CMOS technology has been coming on strong ever since. ICE estimates that CMOS PLDs will account for 37% of the worldwide market this year and 57% of the PLD market by the end of 1994.

But Asian demand for CMOS PLDs has so far been slow to take off. Officials at AMD and the other bipolar companies say the shift to CMOS PLDs has been sluggish partly because of the Asian electronics industry's emphasis on manufacturing PCs and related products, which often require the extra speed of bipolar devices.

Chip designers are still a long way



from producing CMOS PLDs fast enough to keep up with the latest bipolar devices. The fastest CMOS PLDs currently are in the 10-nanosecond range, half the speed of the latest TTL bipolar devices.

But what CMOS PLDs lack in speed, they more than make up for in terms of power consumption and density. CMOS PLDs are ideally suited for use in laptop and notebook PCs, as well as cellular phones and other battery-powered products, because they typically require less than half as much power as their bipolar equivalents. CMOS technology also allows much more circuitry to be squeezed into a smaller package—another advantage in building lightweight and portable products.

Most CMOS PLDs have a further advantage of being reprogrammable, which makes it easier for engineers to correct mistakes and update designs. Some varieties, such as those that use electrically erasable programmable memory (EEPROM) technology, can be reprogrammed electrically without removing them from the system where they are installed.

"Asia is still higher than the worldwide average in terms of bipolar consumption, but the CMOS segment is also growing very strongly," says Soon Loh, AMD's Asian business development manager.

No single company controls the fast-growing CMOS market to the extent AMD dominated the bipolar market. The leading CMOS supplier during 1989 was Altera Corp. of Santa Clara, Calif., whose sales of $50 million accounted for 19% of the market. A group of other relatively small U.S.-based companies—Cypress Semiconductor Corp., Xilinx Corp., and Lattice Semiconductor Corp.—held the next three places, according to ICE.

Erik Cleage, Altera's director of sales for Japan and Asia, says the seven-year-old company sells about 17% of its PLDs in Japan, and another 3% to 4% in the rest of Asia. Altera makes a wide range of CMOS PLDs, from inexpensive varieties aimed at replacing standard PAL devices, up to complex gate-array-like PLDs with up to 5,000 gates or transistors. A 20,000-gate product is scheduled for introduction sometime next year.

About $100 million worth of PLDs were sold in Japan last year while sales in the rest of Asia were over $50 million

While Asian semiconductor makers held 11 of the top 20 spots in Dataquest Inc.'s 1989 ranking of the largest chip makers, there are virtually no Japanese or Asian companies to be found in the PLD market. However, with the exception of N.V. Philips of the Netherlands and its U.S. subsidiary, Signetics, the PLD industry is dominated by the United States.

One of the few Asian companies trying to break into PLDs is Korea's Hyundai Electronic Industries Co., but so far its sales account for only a fraction of 1% of the PLD world market. The reason, say industry observers, is patent protection.

Since 1978 when Monolithic Memories Inc. (MMI) developed the first PAL, U.S. companies have applied for patent protection on their new PLD products and defended patents vigorously. The strength of that protection was demonstrated in April when AMD, which acquired MMI's patent portfolio in a 1987 merger, forced Samsung Semiconductor Inc. to drop PLDs. Samsung had been building PAL-type devices as well as CMOS PLDs based on AMD's 22V10 architecture, and many analysts had already picked Samsung as the next major player at the low end of the market.

"Samsung suffered a major setback in the PLD patent case with AMD," according to Bill McClean, vice president of market research at ICE. "They may return with a redesigned PLD product," he continues, "but it will be a while before Korean producers are strong PLD competitors."

Patents should pose less of a problem for Hyundai, with its technology licensed from San Jose, Calif.-based International CMOS Technology Inc. Hyundai also owns 30% of ICT. "We can apply that technology to modified or enhanced versions," according to Han. Still, he admits Hyundai does not have the "capability to develop a whole different type of PLD."

Several Japanese chip makers, including Fujitsu Ltd., Toshiba Corp., and Ricoh, have dabbled in the market, but none has yet made a significant product introduction. One reason for Japanese makers' reluctance is the small size of the PLD market. But that explanation now carries less weight as PLD sales rapidly approach the $1 billion mark.

"If there were no patents to contend with, I believe any of the Asian manufacturers would love to be in the market," according to AMD's Loh. □

Workstations battle PCs for rights to the technical desktop

CAD/CAM/CAE is shaping up as a pivotal battleground for workstation and personal computer vendors vying to establish the standard technical platform of the future

BY PETER BURROWS

What happened to the days when a workstation was a workstation and a personal computer was a personal computer? When you bought the former, you got a high-performance item based on the powerful Unix operating system for big bucks directly from the manufacturer through a highly trained salesperson. When you bought a PC, you got an easy-to-use jack-of-all-trades that could be bought almost anywhere for a few thousand dollars.

If not gone entirely, those days are rapidly disappearing. Some workstations now cost as little as $5,000 and can run Unix-based versions of such PC software standards as Lotus 1-2-3 and WordPerfect. With vendors eagerly looking for new sales channels to increase volume, workstations are beginning to show up more often at the dealerships, value-added resellers (VARs), and other third-party outlets that make up the traditional channel for PC distribution.

At the same time, high-end PCs now rival workstations in power, performance, and even price. Fully loaded configurations armed with Intel Corp.'s state-of-the-art 80486 microprocessor, extra memory, and enhanced graphics and networking can sell for almost $20,000, and many are being used for high-end applications, such as three-dimensional modeling, that were never before considered to be within the realm of the PC platform.

Nowhere is the overlap between the two platforms more clear than in the market for computer-aided-design (CAD), computer-aided-manufacturing (CAM), and computer-aided-engineering (CAE) software tools. Rapid improvements in the price/performance of workstations recently have caused CAD/CAM/CAE users, software developers, and resellers of every description to revise their strategies. The fallout, which analysts say will be evident within the next few years, will say a great deal about what the technical computing platform of the future will look like.

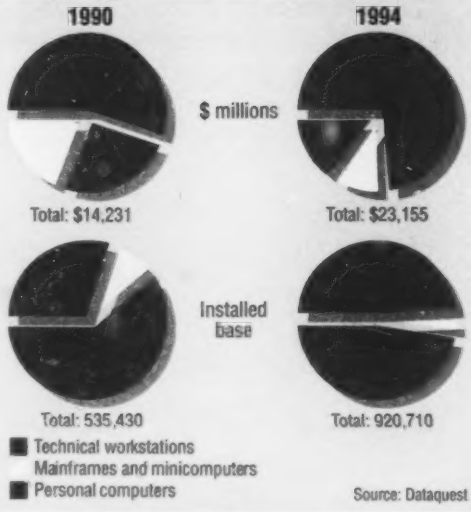
For now CAD/CAM/CAE remains a PC-based industry. More than twice as many PCs as workstations were sold into these markets in 1989 (279,200 and 116,500, respectively), according to market researcher Dataquest Inc. in San Jose. However Charles Foundyller, president of Daratech Inc., based in Cambridge, Mass., estimates much greater PC dominance; he believes that workstations represented only about 5% of total CAD/CAM/CAE hardware sales in 1989.

One scenario, promoted most aggressively by Sun Microsystems Inc. of Mountain View, Calif., would see the workstation completely replace IBM PCs and compatibles as the standard platform for CAD/CAM/CAE, as well as for more general business applications. By liberally licensing its scalable portable architecture (SPARC) and expanding its third-party sales channels, Sun has made impressive strides in breaking into the high-end PC marketplace. But other major workstation vendors, such as IBM and Hewlett-Packard Co., say the convergence of PC and workstation technology is a moot point. "We see them as complementary technologies," says Ron Gentile, a marketing manager of enabling technologies with HP. "Heterogeneous computing is the way it is out there, and neither platform is going to go away."

The numbers bear him out. Sales of workstations and PCs into CAD/CAM/CAE have risen at approximately the same rate since 1985, according to Dataquest numbers—16.8% annually for PCs and 17.5% annually for workstations—as each has grown on the strength of rapidly developing, clearly defined high- and low-end segments of the market.

But now, with a range of technical hurdles crossed

Workstations outpace PCs in CAD/CAM/CAE



and with cutthroat competition compelling workstation vendors to seek out high-volume sales in the low end of the market, observers expect the scales to tip in the workstations' favor. Kathryn Hale, a senior industry analyst for Dataquest, expects workstations to overtake PCs in yearly unit sales by 1994, based on annual sales growth of 12.9% between 1990 and 1994, compared with 5% annual growth for the PC during that period.

Minicomputers and mainframes, running software costing upwards of $100,000, dominated CAD/CAM/CAE until Autodesk Inc., in Sausalito, Calif., revolutionized the market in 1982 by selling low-cost PC-based products for about $1,000. Dataquest expects minicomputer and mainframe sales into the CAD/CAM/CAE market to fall 9.2% per year through 1994, from 48,720 units to 33,270 units.

Unix comes on strong

Technically, the choice between PCs and workstations has become confused. While PCs typically still offer lower absolute systems costs, given the lower cost of PC software, many workstations offer better price/performance for the hardware itself. Workstation costs have been falling 15% per year, several industry insiders estimate, and they expect this curve to steepen in coming years. In many ways, the technologies have already converged; while workstations are designed with networking capabilities, superior graphics, and virtual memory, PCs can be outfitted with those features.

"We have to write next year's hardware budget so that we're ready for whatever the future holds, because who knows what's going to happen by then?" says Jerry Flynn, a design engineer with the McDonnell Douglas Space Systems Co. at its division at the John F. Kennedy Space Center in Florida.

Flynn, who uses a system featuring DOS- and Macintosh-based PCs as well as workstations, with software that is fully compatible with all three, expects workstations to advance as far as the software available for the platform will take them. Where DOS was developed for stand-alone hardware on which individual tasks are done one at a time, Unix, the standard for major commercial workstation platforms, offers multitasking (the ability to run more than one application at a time) and superior data-management capabilities in a multiuser environment. "And now," Flynn says, "all of the reasons for not going to Unix are kind of dissolving away."

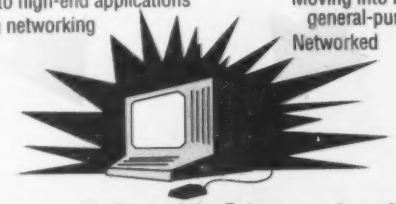
Progress has been made in a number of areas:

- Ease of use. Software enhancements, such as graphical user interfaces and compilers that easily translate DOS-based programs into Unix formats, have made the much-feared Unix much less difficult to use. While Unix-based operations still typically require the services of a full-time systems manager, users report that in some configurations Unix is all but transparent to the application user.
- Price. Workstation prices have fallen drastically as the cost of memory, disk drives, and chipsets has plummeted. LSI Logic Corp. in Milpitas, Calif., for example, is selling its SparKit chipset at prices designed to "enable the low-end workstation vendors to sell their products for $5,000 or $6,000," marketing director Prem Nath reports. The result is a changing of the guard in pricing for a growing segment of the market. One vendor of both PC and workstation-based CAD/CAM/CAE solutions lists a low-end SPARCstation IPC from Sun at $9,995. A high-end DOS machine, the Deskpro 486/25 from Houston-based Compaq Computer Corp., configured for similar performance, lists for $13,999.
- Application availability. Long regarded as a platform only for highly specific, highly complex applications, many CAD/CAM/CAE vendors—including four of the five market leaders—now offer their core products on Unix-based workstations as well as DOS-based PCs. Some are responding to incentives from hardware vendors anxious to reach a critical mass of software for their platforms. Others are fearful of being left behind should Unix take hold at the lower end of the market. "We want to fit into every engineer's desktop environment, and in our market there simply happens to be two standards," says Jon K. Hirschtick, chairman of mechanical CAD vendor Premise Inc. in Cambridge, Mass. His company's product runs four to five times faster under Unix than under DOS, he claims.
- Accessibility. For the above reasons and more, a variety of distributors, dealers, systems integrators, and VARs are now selling workstations and Unix-based CAD/CAM/CAE tools. While the high cost of hiring and training Unix-literate personnel

There are some signs of a resurgence of DOS-based PCs in the world of CAD/CAM/CAE

Convergence of workstations and PCs

	PCs	Workstations
1980	Low cost Low-end, general purpose Stand-alone	High cost High-end, specific applications Networked
1990	Rapidly rising performance Slowly falling prices Moving into high-end applications increasing networking	Rising performance Rapidly falling prices Moving into low-end, general-purpose applications Networked
2000		

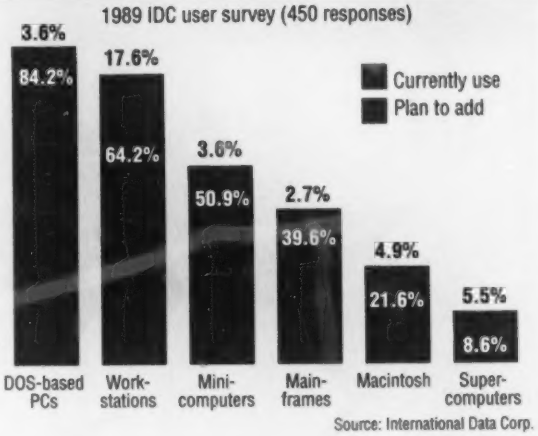


Platform of the Future

Source: ELECTRONIC BUSINESS

represents a high barrier to entry, these resellers are attracted by the promise of higher margins than on PC-based systems, as well as by limited competition as the channels develop. The results so far indicate that these third parties represent an effective mechanism for expanding workstation sales. Sun reports that its 150 dealers have doubled sales over the past year. VAR sales on the whole, according to Daratech, are outpacing the industry, with annual sales growth of 33% compared with 13% for CAD/CAM/CAE in general.

The PC has volume; the workstation has growth



Source: International Data Corp.

Whither the PC?

Some observers contend that the PC is ripe for a fall. But recent developments such as the introduction of Microsoft Corp.'s Windows 3.0 and the existence of hundreds of DOS-extender programs and PC-accelerator cards have given new life to this nine-year-old technology, some say. But doubters counter that those developments are simply more evidence that the PC needs artificial respiration to keep up with the times. Jeff Arnst, a market-segment manager with Sun, estimates that 35% of all PC-based CAD/CAM/CAE tools are currently running on extended versions of DOS.

But the PC isn't going away—far from it. Reseller channels for workstations will take years to develop, since resellers must be trained to handle the complexities of Unix, and customers must get used to having an option on the showroom floor. And while many of the thousands of DOS-based CAD/CAM/CAE programs have been converted to Unix recently, few offer true compatibility across platforms—far too few to satisfy the fickle buying habits of PC devotees used to choosing from hundreds of other mature options.

"The PC, if for no other reason than that there are tens of thousands of useful and necessary applications for every aspect of business at extremely attractive prices, will continue to be a high-demand platform," according to Dave Millman, marketing director of the PiCAD division of CADAM Inc. in Burbank, Calif., an IBM subsidiary, which entered the Unix market this year.

But an estimated installed base of between 35 million and 50 million devoted DOS users may be the most imposing barrier for competing platforms. "DOS may be an inelegant solution to some problems as of now," according to Daratech's Foundyller, "but it has the unit volume to make it worthwhile for someone to find a way to get around its limitations. With all those clever people working on the problem, it is highly unlikely that they will be unsuccessful."

Users, software developers, and resellers are caught in limbo as the two platforms converge

Indeed, there are some signs of a resurgence of DOS-based PCs in the world of CAD/CAM/CAE. Evidence includes the failure of OS/2, the much-hyped multiuser operating system for the PC introduced by Microsoft in 1987 to provide a migration path for DOS users, which has yet to overcome resistance from application developers. While Microsoft will introduce a new release of the operating system sometime next year to run on 80386 machine, users and software vendors complain that the standard has not been made sufficiently attractive and consider it a stopgap solution.

Clearing the confusion

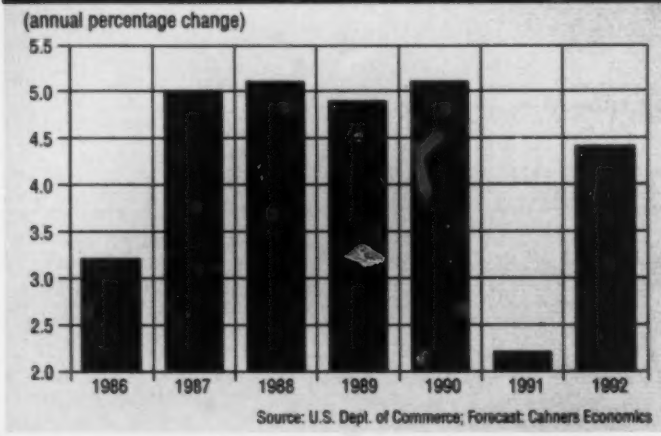
Users, software developers, and resellers are caught in limbo as the two platforms converge into each other's turf, and the onus increasingly rests with the hardware vendors to deal more directly with the issue. Besides Sun, few hardware vendors have clearly outlined their view of how the collision will shake Cut—possibly because major competitors such as IBM and Compaq, who offer products in both of the categories, have yet to deal with the question themselves.

"The question is, can the PC vendors continue to add more integration to their platform faster than the workstation vendors can achieve a general-purpose platform?" according to Steve Malisewski, director of applications marketing for Compaq. "The workstation vendors may have raced ahead in terms of integrating everything the user needs into one computer, but there aren't any barriers to the PC industry following their lead. We are all building our products from the same shopping cart."

Compaq, for one, has given indications that the end result may well be a shake-up of the current industry profile. The company, the quintessential premium PC vendor, has discussed opportunities involving the SPARC architecture with Sun, although it has not disclosed details. A growing number of other PC makers are also making the move into the workstation business: In mid-October, LSI Logic announced that vendors including CompuAdd Corp. in Austin, Tex., DTK Computer in Taiwan, and Hyundai Electronics in Korea, are building SPARC-based products based on LSI's SparKit chipset.

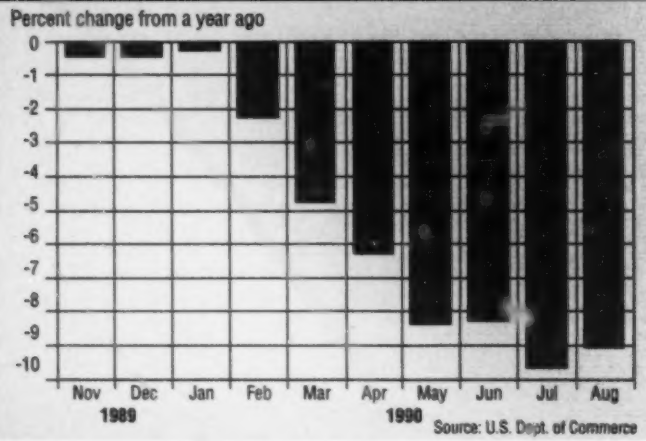
"When you look over the horizon, you see that it will take a 32-bit operating system to do what we will need to do someday," according to Compaq's Malisewski. "When it's necessary, we will move into that domain." □

Communications equipment shipments



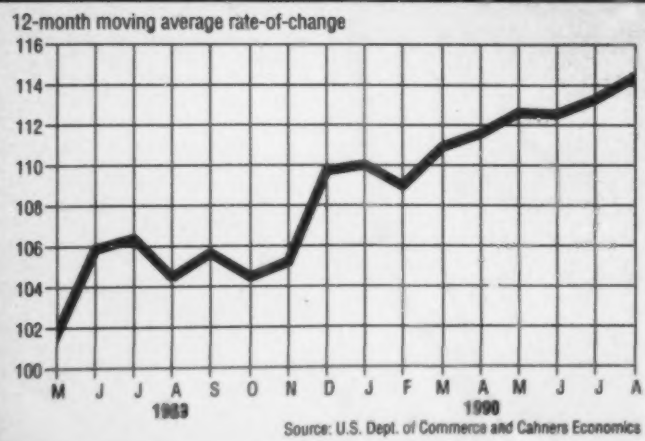
Source: U.S. Dept. of Commerce; Forecast: Cahners Economics

Communications equipment inventory



Source: U.S. Dept. of Commerce

Nondefense communications equipment orders



Source: U.S. Dept. of Commerce and Cahners Economics

New orders rise for communication products

By the end of the summer, growth in shipments of communication equipment was running about two percentage points higher than Cahners Economics' expectations. If this trend continues, total shipments could expand by 7% to 8% this year, once all data are in, rather than our current forecast of 5.1%. Not surprisingly, manufacturers have kept a lid on production growth during the current economic slowdown and have instead whittled away at inventory to keep shipments growing.

The surprising news is the increased flow of orders received by U.S. factories. With 12 months of data ending in August, net new orders for communication equipment swelled to $83.2 billion—11.8% above the prior 12-month period. So far, the upward growth trend has not been knocked off-track by the happenings in the Middle East. This strength in new orders has stemmed the decline in backlogs that began in the middle of 1988.

In particular, non-defense communication equipment suppliers have enjoyed a steady stream of orders. Growth rates have risen almost unabated since the middle of 1989, resulting from the burgeoning need for voice, data, and video communication. Driving the demand are productivity enhancements and cost savings from installing digital networks, as well as newly opened foreign markets. With the 12 months ending in August, net new orders for telecommunication and data-communication equipment swelled 14% from the prior year.

One sector experiencing rapid growth is fiber optics. The U.S. Department of Commerce estimated that the U.S. fiber-optics market grew 7%, to about $1.1 billion in 1989, including parts, systems, and cable. The telecommunications industry consumed over three-quarters of fiber-optic production, but with most long-distance and regional systems overhauled and the cost of deploying fiber declining, fiber optics is moving into the local loop—the delivery of service from a telephone company's central office to a home or business. Business Research Group in Boston predicts the total number of regional Bell operating companies' fiber access lines to the customer will grow nearly 15% annually between 1990 and 1995. Fiber optics also is being used increasingly in local area networks, cable television networks, and military applications.

MADELINE FRANCHI

Blue chip vs. Cahners macroeconomic forecasts

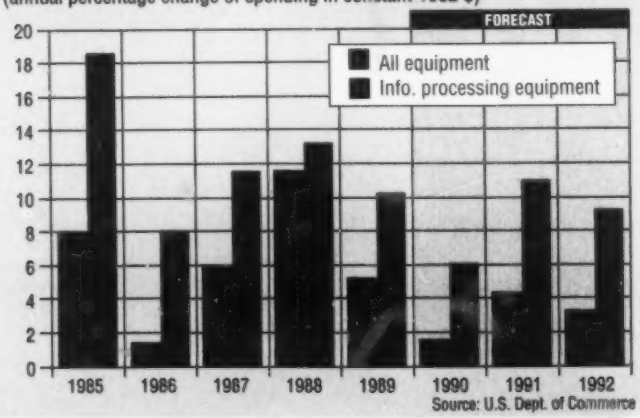
(annual percentage change)

	Blue Chip Consensus		Cahners Economics	
	1990	1991	1990	1991
Real GNP	1.0	0.8	1.4	2.4
Consumer price index	5.4	5.1	5.4	3.9
Industrial output	1.1	0.8	1.3	2.7
Disposable income	1.2	0.8	1.5	2.1
Business investment	0.5	-0.5	1.3	3.8
Pretax profits	-4.2	0.7	-3.4	5.0

Source: Blue Chip Economic Indicators and Cahners Economics

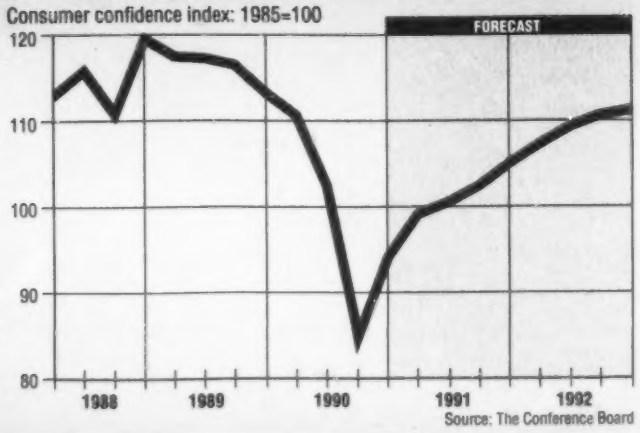
Business investment growth will pick up...

(annual percentage change of spending in constant 1982 $)



Source: U.S. Dept. of Commerce

...And so will consumer confidence



Source: The Conference Board

U.S. economy can avert an oil-shock recession

What a difference a crisis in the Middle East makes. The economic consensus forecasts have taken a turn for the worse. According to the Blue Chip Economic Consensus in Sedona, Ariz., 50 forecasters in the U.S. last month estimate on average that real GNP will rise just 1.0% in 1990 and a meager 0.8% in 1991. Prior to Iraq's invasion of Kuwait, the group had been forecasting 1.9% and 2.2% growth, respectively. (In the March 5, 1990 issue of ELECTRONIC BUSINESS, the consensus' forecast had been 1.6% and 2.5% GNP growth.)

But the true impact on the economy of the current Gulf crisis remains largely unknown. Without further interruptions in that region's crude-oil supplies, the shortfall is minor and is rapidly being made up by other countries. The commodities market has hurled oil prices into the stratosphere, but the price of oil would have to remain above $60 a barrel to equal the shock produced in 1974.

The result of continued uncertainty and bruised consumer confidence will no doubt mean less economic growth next year. However, we at Cahners Economics maintain real GNP will grow 2.4% in 1991. That prediction has been lowered from the July forecast of 2.8% and a forecast of 3% published last March.

What makes Cahners Economics a relative optimist about next year? We specialize in forecasting micro markets. The forecasts for industrial products, materials, electronic components, building materials, and other discrete markets underlie our GNP forecast. We also focus on the turning points in the business cycles for these markets. According to our analysis, the industrial base of the economy is poised for a turnaround now, although the expansion will be somewhat muted.

The recession, if it does happen, will be led by a severe cutback in consumer spending and could easily be prompted by a war in the Middle East. Yet without a war, it is still a safe bet that the U.S. economy will slink by in 1991 with 2% growth or above.

ELIZABETH B. BAATZ